Space Weather Technical Forecast

Issued on Thursday, 17 November 2022 at 12:05 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Decreasing chance of M-class flares (Minor to Moderate radio blackouts). Slight Chance of G1 (Minor Storm) from late Day 3 (19 Nov) onwards.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been at Low levels, with often frequent but low level C-class flare activity. The largest flare was a C6 at 17/0928 UTC originating from AR3145.

There are now five numbered regions on the visible disc. Aside from the group mentioned above the other four regions are either small and magnetically simple at present, with one larger single uni-polar spot (AR3147 Hhx/Alpha) which is currently stable. Three are located toward the eastern limb, with the other located in the northwest quadrant.

No Earth-directed CMEs have been observed in available imagery. A partial filament eruption in the southwest quadrant around 16/1200 UTC resulted in a slow CME. Modelling does not indicate any significant impacts at Earth.

Solar Wind / Geomagnetic Activity: The solar wind as observed at L1 by ACE/DSCOVR, has been slow-ambient between 300-360 km/s, but with a slight upward trend in the most recent observations. Density has been at average to below average levels. The total magnetic field strength (IMF) has been weak throughout remaining below 6 nT. The north-south component, Bz, has fluctuated weakly between +6/-4 nT. Phi angle was negative (towards the Sun) until around 17/0900 UTC, then switched to positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has been at background to moderate levels, with a peak of 343 pfu at 16/1740 UTC. Electron fluence levels remained well below Active (1e8 integrated pfu) levels, with a very slight rising trend. Observed fluence at 17/00000 UTC was 6.89e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain generally Low during the period. There is a diminishing chance and slight chance of both isolated M-class and X-flares through days 1 and 2, from ex-AR3140 and ex-AR3141 as they continue to rotate away from beyond the northwest limb

Solar Wind / Geomagnetic Activity: No significant Earth-directed CMEs are expected during the period, although some minor CME effects are possible from a weak glancing pass, late on day 1 (17 Nov) or during day 2 (18 Nov).

Solar winds are currently at slow-ambient levels and expected to remain so through Days 1 and

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2. An enhancement is likely from later on Day 3 (19 Nov) as the large negative polarity coronal hole in the southwest disc starts to become geoeffective, with enhancement then persisting into Day 4 (20 Nov). Geomagnetic activity is forecast to be predominantly Quiet through Day 1 and into 2, with a slight chance of isolated Unsettled or Active intervals should any CME effects manifest. Later on Day 3 and into Day 4 Unsettled to Active levels are likely to develop with a slight chance of an isolated G1 (Minor Storm) under HSS influence.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is most likely to remain at background levels throughout. However, there is initially a slight chance of a solar radiation storm from ex-AR3140 and ex-AR3141 now located beyond the northwest limb. Electron flux is forecast to remain at mostly background to moderate levels throughout the period. Fluence values are expected to remain below or well below the Active (1e8 integrated pfu) threshold throughout the period.

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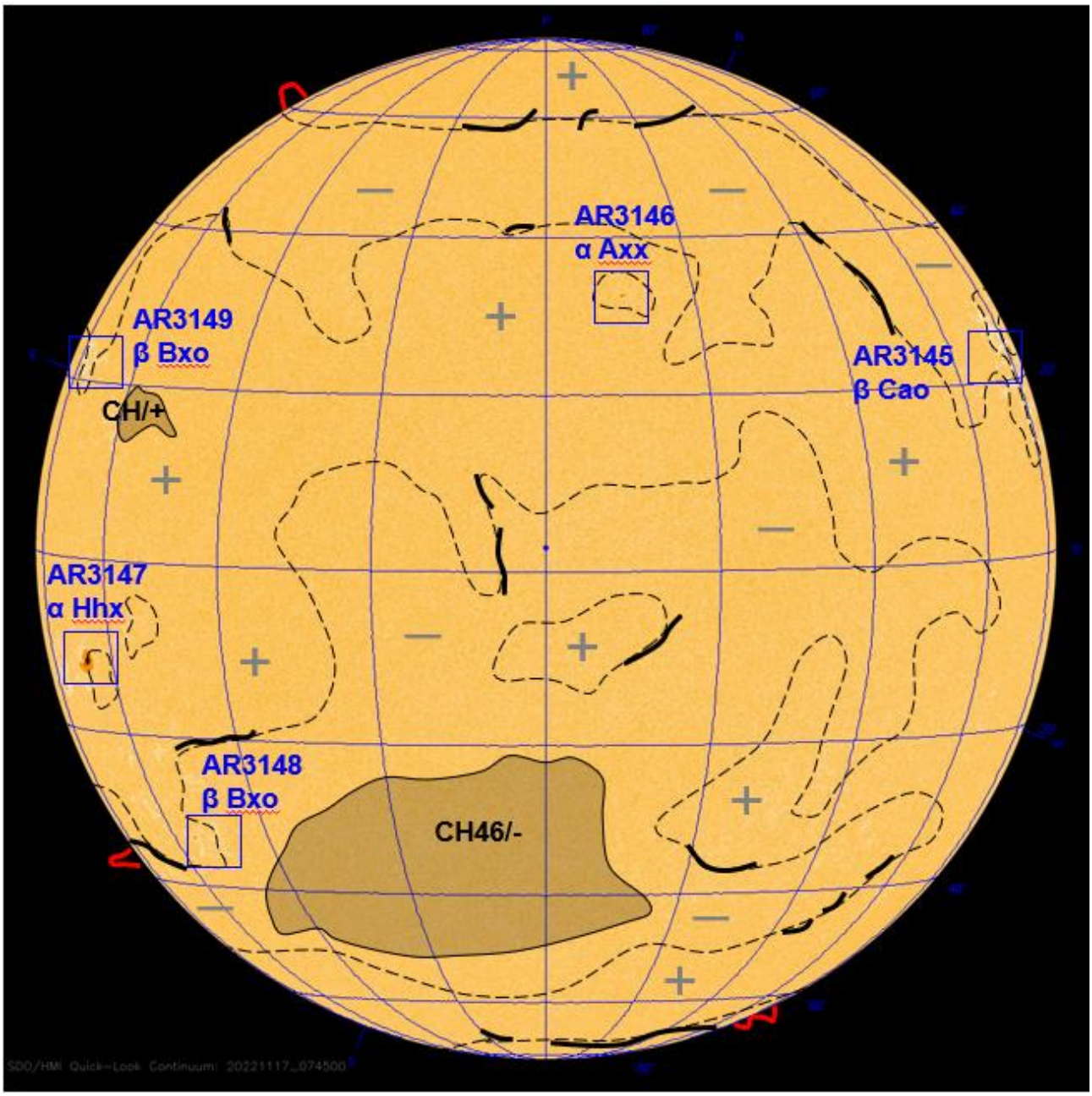
Figure 1. Solar Analysis Valid 17/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No significant Earth-directed CMEs are expected during the period, although some minor CME effects are possible. Two filament lift-offs were observed on the 13 Nov and 14 Nov, and these are predicted to pass ahead of Earth's orbit, but could give a weak glancing interaction either late on Day 1 (17 Nov), or more likely, during Day 2 (18 Nov). However, significant impacts are unlikely if encountered at Earth. A partial filament eruption in the southwest quadrant around 16/1200 UTC resulted in a slow CME. Modelling does not indicate any significant impacts at Earth.

Solar winds are currently at slow-ambient levels and expected to remain so through Days 1 and 2. An enhancement is likely from later on Day 3 (19 Nov) as the large negative polarity coronal hole in the southwest disc starts to become geoeffective, with enhancement then persisting into Day 4 (20 Nov). Geomagnetic activity is forecast to be predominantly Quiet through Day 1 and into 2, with a slight chance of isolated Unsettled or Active intervals should any CME effects manifest. Later on Day 3 and into Day 4 Unsettled to Active levels are likely to develop with a slight chance of an isolated G1 (Minor Storm) under HSS influence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Radio Blackouts - X-Ray Flares:

Solar activity is expected to remain generally Low during the period. There is a diminishing chance and slight chance of both isolated M-class and X-flares through days 1 and 2, from ex-AR3140 and ex-AR3141 as they continue to rotate away from beyond the northwest limb. No further significant active regions currently expected to rotate onto the disk until perhaps Day 4 (20 Nov).

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	20	10	10
Very Active	R3 to R5 X Class	No	10	5	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, as observed by GOES-16, is currently at background levels and is most likely to remain at this level throughout the period. However, the presence of AR3140 and AR3141, now beyond the northwest limb, will initially pose a slight but declining risk of proton storms over background conditions, and this is reflected in the probabilities given in the table.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	5	2	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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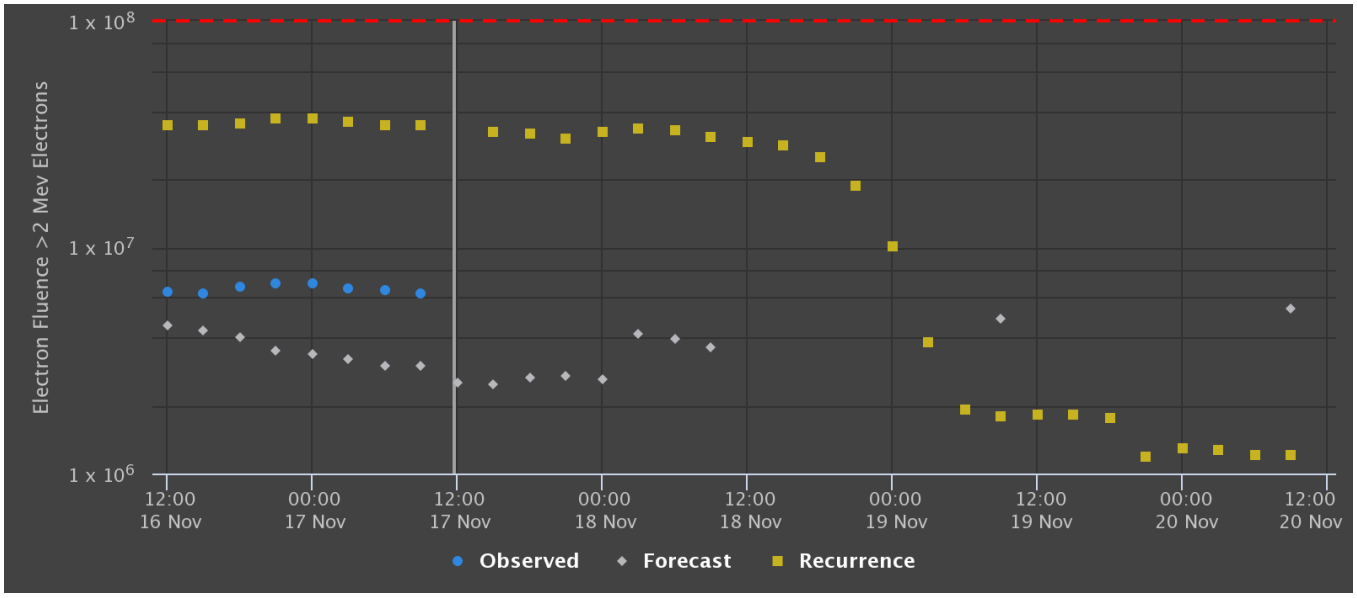
High Energy Electrons Event (≥ 2MeV):

Electron flux (greater than 2MeV) is currently at mostly background levels and is forecast to be at background to moderate levels through much of the coming 4-day period.

Electron fluence values are well below the Active (1e8 integrated pfu) threshold and are expected to remain so throughout the period. The MOSWOC REFM output currently supports electron fluence values remaining below the Active threshold which offers good guidance. Fluence levels on the last rotation remained below the Active threshold with slightly faster wind speeds, and a similar trend is considered to be a probable outcome.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REFM



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